United States
Department of
Agriculture

Forest
Service

Hoosier
National
Forest

Hoosier
National Forest

Biological Evaluation for Regional Foresters Sensitive Species

Houston South Project

June 18, 2019

Prepared by: Steve Harriss
Wildlife Biologist
Hoosier National Forest

I. Introduction

The intent of this biological evaluation (BE) is to ensure that decisions regarding land management are made with the benefit of recent scientific information regarding Regional Forester Sensitive Species (RFSS) and the habitats they may occupy on the Hoosier National Forest. Additionally, the purpose is to document the potential effects of implementing the proposed Houston South Vegetation Management and Restoration Project (Houston South) on these species and the habitats they may occupy on the Hoosier National Forest. The final emphasis of this document is to ensure that these species receive consideration in the decision-making process, thereby ensuring compliance with the Endangered Species Act, National Forest Management Act, direction within Forest Service Manual Sections 2620 and 2670, and Forest Service Handbook 2609.13 (USDA FS 1991, USDA FS 2005):

The Hoosier National Forest - Regional Forester Sensitive Species list includes:

• Mammals	4 species
• Birds	6 species
• Fish	6 species
• Amphibians	2 species
• Reptiles	1 species
• Mollusks	2 species
• Terrestrial Invertebrates	47 species
• Karst Invertebrates	37 species
• Vascular plants	34 species
• Non-vascular plants	2 species
	141 species total

Vascular plants and non-vascular plants were evaluated in a separate report by the forest botanist (Coon 2019a). Therefore, 105 species were evaluated in this report.

The Indiana Department of Natural Resources, Division of Nature Preserves, database was consulted for records of occurrence of species relevant to this evaluation (IDNR 2015, 2012). Records were also reviewed from the most recent mist-netting bat survey conducted on the Hoosier (McClanahan 2014, York-Harris 2016). The 2018 breeding indices for ruffed grouse were also reviewed (Backs 2018). In addition to this, the author of this evaluation used the best available science in making determinations to accompany this project-specific data.

II. Purpose and Need

The Houston South Project proposed action is based on, and would fulfill, Forest Plan direction associated with the goal of maintaining and restoring sustainable ecosystems. This project would meet Forest Plan direction to promote tree growth, reduce insect and disease levels and move the landscape toward historic conditions. It would also increase the resiliency and structure of forested areas (stands) by restoring the composition, structure, pattern and ecological processes necessary to make these ecosystems sustainable.

There is a need to provide a mosaic of forest conditions dominated by hardwoods and restore dry hardwood forest ecosystems that have not experienced periodic disturbance due to fire or other naturally occurring events.

As maturing oaks and hickories age and die, they are being replaced by trees such as maple and beech. The oak and hickory provide hard mast-acorns and nuts-that are critical food for many wildlife species. Oak-hickory ecosystems need management activities to regenerate due to severe competition by less desirable species.

A lack of fire in the area is also causing oak-hickory seedlings to be suppressed by a shade tolerant mid-story. Reintroducing fire would promote regeneration and maintenance of mast producing oak and hickory. Secondly, there is a need to reduce the amount of pine in the project area to provide more suitable habitat to a wider array of wildlife species. Pines were planted in the 1940's and 1970's to aid in erosion control.

Pines are not native to the Hoosier National Forest. As the nonnative pine stands mature, the canopy grows closer together and reduces the amount of sunlight reaching the forest floor. The ground beneath the stands, in many places, has little (if any) other plants growing to provide cover or food sources for wildlife. By removing the pine plantations, the amount of forested habitat that is between 0 and 9 years of age would increase. The Forest Plan states the desired condition of this area is to maintain 4 to 12 percent of the area in young forest habitat.

Stand density is very high in portions of the project area and mortality is occurring. The proposal would reduce the density of the trees, improving forest health. Promoting healthy forest conditions and improving stand structure within the project area would improve the overall health of vegetation in the project area, making the ecosystem more resilient and reduce the effects of insects, disease, and climate change.

Lastly, there are also opportunities to repair poorly maintained roads and eroded areas to reduce sediment deposition into streams and lakes in the project area. Additionally, roads and trails in the project area may be better located to reduce sedimentation and increase viability of aquatic organisms. These actions may include relocating, reconstructing, or obliterating roads and possible placement of aquatic organism passages (large culverts) in the project area.

Alternative 1 – Proposed Action

The Hoosier National Forest (Forest) proposes to promote regeneration of oak and hickory habitat and increase the amount of early successional habitat available through the use of timber harvest, herbicide treatments and prescribed fire. The current proposal implements approximately 1,131 acres of even aged management which would create an estimated 8 percent of National Forest System (NFS) land in the project area in a 0 to 9 year old age class. The overall project area is approximately 23,359 acres (13,526 NFS acres and 9,833 private acres).

Table 1: Proposed silivculutral treatments

Harvest	MA	Veg Type	Acres	Subtotal
Clearcut	2.8	Pine	401	
Shelterwood	2.8	Hardwood	703	
Total Even-aged mgmt	**2.8**	**Both**	**1104**	**1104**
Thinning	2.8	Hardwood	2327	2,327
	2.8	Pine	78	78
Selection	2.8	Hardwood	462	462
Midstory Removal	2.8	Hardwood	234	234
Crop Tree Release	2.8	Hardwood	170	170
			Total	**4,375**

The proposal also includes additional treatment of areas where timber is removed to promote regeneration of oak and hickory habitat. Total silvicultural treatments are 4,375 acres (Table 1). The tools for promoting oak and hickory include, but are not limited to, understory removal, prescribed fire, and herbicide treatment. The intent is to use controlled fire or mimic the outcomes to create habitat that is conducive to regenerating oak and hickory.

Prescribed burn treatments are proposed to enhance habitat conditions to promote oak and hickory regeneration for mast in Management Area (MA) 2.8 and improve habitat for wildlife and plant species in MA 2.4 and 6.4. The Preliminary Proposed Action map displays the burn block area. Several prescribed burns (15-22 estimated) would occur within this burn block at different intervals, not the entire burn block at once. Estimates for total acres for prescribed burning are 13,300 acres.

The vast majority of prescribed burns would not occur during bat's active period of April 15–September 15. However, this project was designed to take advantage of potentially longer burn windows that could occur. This means that prescribed burn activities for the Houston South Project could also occur during the growing season (active period for bats), on April 15 and through September 15. Albeit, this would be infrequent and possibly considered a rare event due to the onset of green up.

Prescribed burning also involves removing trees that could be a hazard to firefighters or that could impact the fireline. This removal of hazard trees would occur during times of bat inactivity while prepping the units prior to a prescribed burn. The one exception would be if the fireline or human safety were in jeopardy during a prescribed burn activity. The estimate amount of firelines to be assessed for hazard trees ranges from 66 to 74 miles. It is difficult to determine the quantity of hazard trees per mile of fireline that could be taken. This depends on the species present, topography and density. As a general rule, an increase in fireline would increase the hazard tree potential and therefore an increase in the amount of potential roosting trees.

The project also proposes road construction and reconstruction. There are approximately 16.2 miles of Forest Service roads (FSR) in the project area. The majority, 15 miles, are Maintenance Level (ML) 1 roads with 0.7 miles of ML 2 and 0.5 miles of ML 3. It is estimated that 6.2 miles of roads would be decommissioned. Of the approximate 16.2 miles of FSR, 8.6 are co-located with trails; however, 4.6 miles are in the area of proposed timber management. This includes the southern section of the Fork Ridge Trail and portions of the Hickory Ridge Trail system. Roads that are to be decommissioned could have vernal pools installed in their footprint where appropriate. Vernal pool installation could also occur on temporary roads or skid trail for rehabilitation purposes.

The analysis would consider opportunities to repair poorly maintained roads and eroded areas to reduce sediment deposition into streams and lakes in the project area. Additionally, roads in the project area may be better located to reduce sedimentation. Opportunities may exist to relocate, reconstruct, or obliterate roads in the project area while providing adequate aquatic organism passage (AOP). Project implementation would begin in 2020, be staged over time and may take several years to complete. The work would be completed using contracts as well as Forest Service employees. In summary, the main treatments to be analyzed would be silvicultural treatments, herbicide treatments, prescribed fire, road construction/reconstruction, AOP and vernal pool installation.

Alternative 2 – No Action
With this alternative, none of the recommended road decommissioning or reconstruction would take place. No silvicultural or prescribed fire activities would occur. The benefit of vernal pools and AOPs to bats, herpetological and fish species would not take place. Habitat creation for the ruffed grouse would not occur. This alternative does not meet the purpose and need for this project.

III. Project Area Description

The majority of the project area is in the northwest corner of Jackson County, on the Brownstown Ranger District (Figure 1). A small portion does occur in the northeast corner of Lawrence County.

The legal descriptions for the project area include:

- T7N, R2E, all or portions of Sections 25-28 and 33-36
- T7N, R3E, all or portions of Sections 20-23, 26-30, and 31-36
- T6N, R3W, all or portions of Sections 2-6, 7-11, and 14-18
- T6N, R2E, all or portions of Sections 1- 4, 10-12, and 13

All proposed silvicultural treatments would occur on National Forest System (NFS) lands. Prescribed fire could be applied where adjoining U.S. Army Corps of Engineers land and private landowners express interest and are willing to enter into an agreement.

The project area is over 23,000 acres in size and can be generally described as a mixed-deciduous forest with patches of coniferous trees. Nonnative (NNIS) plants are present throughout the project area with variable concentrations. Tree species present include oak (*Quercus spp*.), maple (*Acer spp.*), beech (*Fagus grandifolia*), and hickory (*Carya spp*.), sycamore (*Platanus occidentalis*) and tulip (*Liriodendron tuliperfera).* Common mesic plant species are found throughout the project area such as greenbriar (*Smilax sp*.), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), mayapple (*Podophyllum peltatum*) and goldenrod (*Solidago spp*.). Pictures depicting the project area may be found in the BE for Threatened and Endangered Species (Harriss 2019, Figures 2-5). A more thorough botanical evaluation, including NNIS, is also available (Coon 2019a, Coon 2019b).

The geographic scope of this biological analysis (direct, indirect and cumulative effects) for terrestrial plants and animals is based on the Ecological Classification System and primary habitat association. The geographic scope of the analysis for Federal TE species was determined by Subsection in which the species are known to occur. This RFSS BE uses the same format.

The project area is within the Brown County Hills Subsection (222Em). The potential vegetation for this subsection includes oak-hickory in the uplands and bottomlands dominate by mesic species, e.g. beech and maple (Figures 2 and 3). Historically fire was a predominant natural disturbance, burning with low frequency and intensity over moderate size areas between natural barriers. Fire, large herbivores, windstorms, insects, and disease created canopy gaps and kept the canopy open on some ridges.

Ecological landtype (ELT) mapping divides the proposed treatment areas into three different ELTs (Van Kley *et al.* 1995). Zhalnin and Parker (2004) conducted a revised ecological classification for the Hoosier National Forest. This information provides the basis for determining potential or suitable habitat for animal and plant species. The approximate acreage amounts (all estimates have been rounded up to eliminate decimals) of the ELT within the proposed project area are:

- ELT 1 – Ridge, (2751 acres; 12%)
- ELT 2 – Slopes, (12821 acres; 55%)
- ELT 6 – Bottomland (7668 acres; 33%)

The project areas may be further characterized by ELTPs. Common ELTPs that could occur within the three ELTs can be found in the BE for Threatened and Endangered Species (Harriss 2019, Table 2).

IV. Consultation History

The Forest Service undertook this biological evaluation in accordance with Forest Service Manual 2670 direction and the 2006 Hoosier National Forest Land and Resource Management Plan (USDA FS 2006). Furthermore, previously communicated terms and conditions of the Biological Opinion on the Land and Resource Management Plan, Hoosier National Forest, Indiana (USDI FWS 2006), were used to formulate determinations regarding the likely impact of the proposed project on RFSS.The Forest Service consulted the Indiana Department of Natural Resources, Division of Nature Preserves, database for records of occurrence of RFSS relevant to this evaluation (IDNR 2015, 2012).

Two related but separate documents evaluated the potential project related effects to Federally listed endangered and threatened (TE) species (Harriss 2019) and Regional Forester Sensitive Species-Plants (Coon 2019a). No formal consultation with the USDI, Fish and Wildlife Service was required for the RFSS. Formal consultation was completed for the TE biological evaluation (Harriss 2019).

V. Field Reconnaissance

The project area was surveyed during 2019 on several occasions (April 8, April 15, April 24, May 3, May 8 and May 15) by, Forest Botanist Cheryl Coon, Wildlife Biologist Steve Harriss, Wildlife Biologist Trainee Bryan King and Biological Science Technician Evie Phelps.

Animal surveys consisted of searching for individuals, signs of their presence (such as scat, tracks, calls or nests) and/or potential habitat. Some species could not be eliminated from further consideration based on known range and because there were no existing field surveys in portions of the project area. The most current IDNR Natural Heritage database was consulted to determine rare animal and plant species in the project area.

Review of the Indiana Heritage Database does indicate presence of RFSS within the project area and the surrounding vicinity (IDNR 2015, 2012). During the site-specific surveys, no RFSS were located. According to the cave database and ground-truthing, there are no known caves located in the project area. The closest cave is approximately 3.5 miles away.

VI. Regional Forester Sensitive Species

There are currently 141 RFSS for the Hoosier National Forest. These sensitive species with known occurrences on the Forest inhabit a diverse array of habitat (Table 2). Animal species include 4 mammals, 6 birds, 6 fish, 2 amphibians, 1 reptiles, 2 mollusks, 47 terrestrial invertebrates and 37 karst invertebrates. There are 34 vascular plants and 2 non-vascular plants on the RFSS list. Plant RFSS were evaluated by the Forest Botanist (Coon 2019a). The Region 9 RFSS list is available at upon request at the Hoosier National Forest office.

The RFSS occur in 10 community types and habitat, plus those wide-ranging species that use diverse habitats. Habitats that do not occur within the project area include cliff, barrens and larger rivers.

Therefore, the proposed project would not be detrimental to the continued viability of populations of sensitive species associated with cliff, barrens, and larger river habitat. Because project activities would not affect these habitat communities, there likewise would be no cumulative effects. Species associated with these habitat types will receive no additional consideration as part of this analysis.

Species are omitted from habitat communities that occur only at one or few isolated sites on the Hoosier National Forest. Additionally, other species are not included because the project area does not contain landscape characteristics, plant community composition or community structure that would suggest suitable habitat based on the current knowledge of existing habitat for these species.

Mesic forests, dry forest types, wetlands, small stream, ponds, caves, open lands and wide-ranging species that use diverse habitats do occur in the project area. Refer to Table 2 at the end of the document, which display all RFSS species with potential habitat within the project area and an effects summary. More thorough tables (Table 3 and Table 4) showing distribution, habitat, ecological landtype phase information and occurrence of RFSS on the Hoosier National Forest can be found in the Project Record for the Houston South Project.

<u>Effects to Mammals</u>
The Allegheny woodrat *(Neotoma magister)* is not found in this District and has no habitat inside the project area or cumulative effects area. Due to the lack of suitable habitat (cliff communities), the species is considered not present and there would be "**no impact**" to this species or their habitat.

The little brown myotis (*Myotis lucifugus)*, tricolored myotis *(Perimyotis subflavus)* and the evening bat *(Nycticeius humeralis)* were the only mammal species, on the current RFSS list, that prefer the type of habitat found in the project area. All three of the bat species on the RFSS list are wide-ranging and could utilize this area for feeding, roosting and corridors. All three bats were considered present and have been located in the

Hoosier National Forest during the 2010 mist-net surveys (McClanahan 2010) or current acoustic monitoring. Lastly, all three of these bat species are listed as state endangered for Indiana.

Activities associated with the Houston South Project may affect the summer habitat of the bat species since the overstory, density and structure would change as result of harvest. Specific Silvicultural treatments and their effects to bat species can be found in the BE for threatened and endangered species (Harriss 2019). Removal of hazard trees for fireline preparation may indirectly affect bat species by removing potential roost trees. Trees to be removed on the fireline would be taken during the bat's inactive period and not cause a direct effect.

Foraging habitat requirements for the little brown myotis are very generalized, feeding in wooded areas, usually around streams (NatureServe 2019). This species is one of the most tolerant of bats in terms of roost selection. Night roosts are located in tree hollows, beneath tree bark, in or under buildings, bridges, crevices in rock, behind shutters or beneath eaves. They may share roosts with other species of bats. Day roosts in attics or mines may be used by large concentrations of bats. Roost tree size is variable.

The little brown bat can be found in one of the caves, in low numbers, inside the cumulative effects boundary. White-nose syndrome (WNS) is known to occur in this species and this species has been hit hard in Indiana. Large declines have been noted during forest hibernacula surveys (Harriss) and this species is now considered rare on the landscape. For Indiana, the little brown bat has been ranked as S2-Imperiled. This is due to either its rarity or restricted range, very few populations, steep declines or other factors making it very vulnerable to extirpation from the state. Globally it are listed as G3-vulnerable which would be vulnerable in the nation or state due to rarity or restricted range, very few populations, steep declines or other factors making it very vulnerable to extirpation (NatureServe 2019).

Unrestrictive timber activities and growing season burns would negatively impact this species concerning roosting, staging/swarming and summer habitat. However, growing season burn would be minimal and not likely during the periods when young are born. Travel corridors and foraging would have short-term effects with long-term benefits for this species. Design criteria, vernal pools and existing cover habitat adjacent to the project area would help this species, but there could still be negative impacts. Therefore, this project "**may impact"** the little brown bat. Since the little brown bat has a rare occurrence on the landscape, the availability of existing cover habitat adjacent to the project area is present and rarity of growing season burns, project activities should not contribute towards federal listing or result in reduced viability of a population or species.

The tricolored bat can roost in tree leaf foliage, predominately in oak leaf clusters (Perry 2007). The size of these trees seems to be almost any tree greater than 1-inch d.b.h. This bat probably feeds within a 5-mile radius of its roosting site. In spring and summer in Indiana, the maximum distance traveled by 19 radio-tagged reproductive females was 4.3 km (Veilleux et al. 2003). This species probably occurs in low densities and is relatively uncommon (NatureServe 2019). This bat has been located roosting under bridges but none were found during the bridge surveys in 2017 (Harriss).

In summer in Arkansas, roosts were most often among dead leaves of oaks in mature (>50-year-old) forest with a relatively complex structure and a hardwood component, but 3 of 7 maternity roosts were in clumps of dead needles of live, large pines (Perry and Thill 2007). In Indiana, pregnant and lactating females roosted exclusively in foliage, typically in clusters of dead leaves and less often in live foliage or squirrel nests (Veilleux et al. 2003).

The tricolored bat can be found in one of the caves, in low numbers, inside the cumulative effects boundary. White-nose syndrome (WNS) is known to occur in this species and this species has been hit hard in Indiana. Large declines have been noted during forest hibernacula surveys (Harriss) and its occurrence is now considered rare. The tricolored bat has been ranked as S2S3-imperieled/vulnerable for Indiana. Globally they are listed as G2-imperiled. This means they are imperiled in the nation because of rarity due to restrictive range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from the nation

Unrestrictive timber activities and growing season burns could negatively impact the tricolored species concerning roosting, staging/swarming and summer habitat if the species is present. Travel corridors and foraging would have short-term effects with long-term benefits for this species. Design criteria, vernal pools and existing cover habitat adjacent to the project area would help this species, but there would still be negative impacts. Therefore, this project "**may impact"** the tricolored bat. Since the tricolored bat has a rare occurrence on the landscape, the availability of existing cover habitat adjacent to the project area is present and rarity of growing season burns, project activities should not contribute towards federal listing or result in reduced viability of a population or species.

No documented sightings have occurred for the evening bat inside the project area or across the forest with recent mist net surveys (McClanahan 2014, York-Harris 2016). However, acoustical monitoring has found evening bats using the Forest in the Pleasant Run unit using road corridors on ridge tops. The evening bat, though wide-ranging, appears to be most closely associated with mature river bottom habitats where it forms colonies within tree cavities or hollows (Whitaker and Gummer 2003). It is possible that these bats may use other habitat types and foraging areas based on personal observation conducting acoustical surveys.

Roosts for the evening bat include cavities in live or dead trees, spaces behind loose tree bark, tree foliage, leaf litter, rock crevices, abandoned burrows in the ground, and nooks, spaces, and crevices in many types of human-made structures. It is rarely found in caves Individuals roosting in trees frequently change roosts. Winter roosts are poorly known in most areas, but individuals in southwestern Missouri roosted primarily in trees and sometimes underground in January-February. Maternity colonies may be found under loose bark, in tree cavities, or in buildings (NatureServe 2019). Evening bats have not been located in caves found within the cumulative effects area. WNS is not known to directly impact this species (WNS2019

For Indiana, the evening bat has been ranked as S1-critically imperiled. This refers to them being critically imperiled in the state because of extreme rarity due to very few populations, very steep declines, or other factors making it very especially vulnerable to extirpation from the state. Globally they are listed as G5-secure. Locally on the forest, this species seems abundant during acoustical surveys.

Due to prescribed burning options in the growing season and unrestrictive dates of timber harvest in the area, project activities "**may impact"** this species. Since the evening bat is considered nationally secure (G5), the availability of existing cover habitat adjacent to the project area is present and project activities would not contribute towards federal listing or result in reduced viability of a population or species, it would not meet the level of likely to impact this species.

Vernal pools are a valuable water source for bat species and provides a forage area for insects as well. Sensitive bat species have been captured in a vernal pool complex on the Pleasant Run Unit in 2010 along with other TE bat species. Due to the installation of vernal pools at some of the road sites, this would help bat species and create a beneficial impact for all bat species.

These determinations also consider white-nosed syndrome that is affecting bat species across the eastern United States. Indiana has WNS present and we are seeing a decrease in bat populations during mist net surveys and winter counts. This project warrants the "no trend toward federal listing"; however, this may change in the next few years.

Effects to Birds

The Henslow's sparrow (*Ammodramus henslowii),* ruffed grouse (*Bonasa umbellus*), cerulean warbler *(Dendroica cerulean),* migrant loggerhead shrike *(Lanius ludovicianus migrans),* American woodcock (*Scolopax minor*) and barn owl (*Tyto alba)* all were analyzed for this project due to habitat types existing inside the project area and cumulative effects area. Review of the Indiana Heritage Database indicated species on the RFSS list do occur within the project area (IDNR 2012, 2015).

Breeding bird survey (BBS) data was also used for the analysis. There were 14,280 observations of 84 bird species from 2001 to 2017 (9 years of data) within the project area. The top six species were red-eyed vireo

(*Vireo olivaceus)*, eastern wood-pewee (*Contopus virens)*, Acadian flycatcher (*Empidonax virescens)*, worm-eating warbler (*Helmitheros vermivorum)* and wood thrush (*Hylocichla mustelina)*. The brown-headed cowbird (*Molothrus ater*) was 7th, but there was an obvious drop going from 6th place (168 fewer observations, approximately 22% less) (Dunning, Riegel 2017). The Henslow's sparrow, cerulean, loggerhead shrike and barn owl are listed as state endangered in Indiana. The woodcock and grouse are listed as species of special concern for Indiana (IDNR 2018).

Wildlife openings do exist in and near the project area but are too small to support Henslow's sparrow. A larger early successional area, greater than 75 acres, does exist inside the cumulative effects boundary. This area is approximately 3 miles away from the project area and does contain Henslow's sparrow. Timber harvest would not take place inside the early successional areas and should not affect the Henslow's sparrow. Prescribed burns would have to have proper timing and return intervals to not decrease habitat for this species.

Pre and post-prescribed burn monitoring would be key to determine effects needed and vegetative structure of the area. Therefore, the Houston South Project may impact the species. With the Forest Plan Standards and Guidelines in place, along with the design criteria, the project should have a **"beneficial impact"** for the Henslow's sparrow, both short and long-term**.** Since this species is listed as G4 (apparently secure) (NatureServe 2019) there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project.

Ruffed grouse are currently thought to exist in 10-13 of the 43 counties of Indiana occupied in 1983. Prospects for population recovery are dismal given the continual advancement of forest succession and population levels have likely dropped below "minimal viable population levels" within most of the current grouse range in Indiana. Ruffed grouse appear destined for extirpation unless significant intervention (e.g., extensive timber harvests of sufficient intensity) or sizable natural disturbances occur across the forested landscape in southcentral Indiana to create a large continuum of early successional forest habitats (Backs 2018).

Habitat is present (dry forest) for the ruffed grouse and the project area contains an early successional component required by this species. The project area contains approximately 123 early successional habitat areas (wildlife openings) totaling approximately 422 acres that could provide early successional habitat for this species. Ruffed grouse breeding population indices (males heard drumming/stop) have been estimated on the Forest since 1979. A survey route runs through the northwest corner of the project area and continues west through the cumulative effects area. The last time a grouse was indicated during the survey was in 2012. Single grouse have been seen on occasion inside the Fork Ridge burn unit in 2012 and along the north end of the project area in April 2016.

No male ruffed grouse were heard drumming on 14 roadside routes (15 stops/route) during the 2018 spring survey. This was the sixth consecutive year that no grouse were heard, with only one heard in the last 7 years (Backs 2018).

Proposed timber harvest and prescribed fire would benefit this species and would provide the habitat that this species greatly needs. Short-term impacts could occur if the species is present by temporarily displacing the species. However, without these proposed treatments, the grouse could be negatively impacted through lack of management.

Proper habitat for the ruffed grouse would be created for this project. Therefore, the Houston South Project may have a **"beneficial impact"** the ruffed grouse. Due to the availability of existing cover habitat adjacent to the project area and the fact that this species is listed as G5 (secure) (NatureServe 2019), there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project.

Regarding the cerulean warbler, this species prefers large tract of mature forest and will be considered present even though no sightings have been recorded. Cerulean Warblers, a species of particular management

concern, were not detected in the 2017 BBS, continuing its decline from 5 detections in 2015, 14 in 2013 and 2011, 46 in 2009. Twelve were detected in 2007 (Dunning, Riegel 2017).

Alteration of habitat type through harvesting and prescribed burning would occur and have a possible impact on this species if they are present. Because of their mobility and availability of adjacent habitat, the proposed project should not have any anticipated adverse effects to the viability of these bird species. Therefore, the project activities "**may impact**" the cerulean warbler and its habitat. Since this species is listed as G4 (apparently secure) (NatureServe 2019), there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project.

Concerning the loggerhead shrike and barn owl, past sighting of the shrike are from over 50 years ago. There have been no sightings of the barn owl. Open areas do exist in the cumulative effects boundary but these two species are not considered present. Consequently, there would be "**no impact**" to these species. There habitat would be impacted in a beneficial way via prescribed burning and enhancement of early successional areas.

American woodcock was analyzed because there are "openings" of early successional habitat in the project area. No woodcock were flushed during site inspections but they are present and have been flushed adjacent to prescribed burns. Seven survey routes are inside the project area with two more inside the cumulative effects area. Twelve woodcocks were counted during the surveys in 2014 and eight in 2016 (Harriss 2014, 2016).

Project activities would promote habitat for the woodcock by enhancing early successional areas, diversifying botanical resources and the creation of vernal pools. Therefore, the Houston South Project would have a "**beneficial impact**" to the American woodcock. Due to design criteria, Forest Plan standards and that this species is listed as G5 (secure) (NatureServe 2019), there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project.

Temporary disturbance to all of these species may occur, if they do inhabit these areas, but sufficient amounts of undisturbed habitat do exist nearby. Because of their mobility and positive long-term effects to their habitat, the proposed project would not have any anticipated adverse effects to the viability of these bird species.

Effects to Fish

There are six fish species currently on the RFSS list. The northern cavefish (*Amblyopsis spelaea*) is restricted to springs or cave streams in subterranean cave waters. No caves were located in the project area. The closest cave is over 3.5 miles away and is not conducive to the northern cavefish. The eel (*Anguilla rostrate)* and lake sturgeon (*Acipenser fulvescens)* have large river requirements that are not present in the project area. The last three fish, the spotted darter (*Etheostoma maculatum),* northern madtom (*Noturus stigmosus)* and channel darter *(Percina copelandi)*, have habitat in the area but have not been located during surveys. Fish sampling has taken place in the project area since 2017 with no results and these fish are not considered present.

Due to lack of potential habitat or the lack of species in the project area, there would be "**no impact**" to any RFSS fish species for the Houston South Project.

Effects to Reptiles

The timber rattlesnake (*Crotalus horridus*) was the only reptile species in this category to be analyzed for this BE due to recorded sightings in the Pleasant Run Unit (IDNR 2015, 2012). Dry forest habitat exists in the project area, which makes the project area likely to have timber rattlesnakes. The project area is not where the majority of consistent sightings have taken place.

Temporary disturbance to individual timber rattlesnakes may occur during project activities, if they do inhabit the project area, but a sufficient amount of undisturbed habitat does exist nearby. Timber operations involving clearcuts are limited to 10 acres in size (USDA FS 2006). Current research in Indiana shows that timber rattlesnake's homerange did not vary among years or treatment areas (clearcut 10 ac, uneven-aged harvests)

and control sites (IDNR 2011, 2010, 2009). Researchers (MacGowan 2016) also had little evidence that the snakes were impacted by timber harvesting as measured by home range, use of harvest areas and daily movements. This study was in even-aged units with 10 acre clearcuts and understory removal in southcentral Indiana. Studies in noreastern Pennsylvania have shown snakes maintained their established activity ranges and broadened the diversity of the habitat they utilized by occupying sites within logging areas (Reinert et al. 2011).

With that said, den sites of timber rattlersnakes (hibernacula) are extremely important to their existence and harvest timber at or near these areas could be detrimental (Brown 1993). Den ingress in the fall usually occurs in late September or early-mid October, and snakes typically emerge in the spring by late April or early May (Purdue Fact Sheet)

Timber Rattlesnakes show a high degree of fidelity to the same den site and studies have shown that Timber Rattlesnakes frequently return to the same den every year. Walker (2000) and Gibson (2003) both found that 100% of all snakes tracked for consecutive years in Indiana returned to the same den from which they emerged, including juvenile snakes.

Thus, timing is critical, and at least for the preservation of timber rattlesnakes, fire is probably best applied during their natural dormant season. In any event, growing season fires should be expected to produce some mortality and possibly high mortality under some conditions. For small relict populations of sensitive or threatened species, dormant season burns or alternatives to fire should be considered. (Beaupre, Douglas 2012)

If hibernacula occur on the site, burning during the early growing season is more likely to have a direct effect on several snake species than burning during the dormant season before they emerge. However, burning during the early growing season does not necessarily mean snakes are going to die.
Low-intensity fire does not consume pre-existing large, coarse woody debris that is important as cover for many herpetofauna. Some snakes (e.g., timber rattlesnakes) are most vulnerable to fire soon after they emerge from winter hibernacula. Early growing-season fire poses a risk to these animals, especially when burning near known hibernacula and when burning relatively large areas. (Harper, C.A., Ford, W.M., Lashley, M.A. et al. 2016).

To date, there are no known rattlesnake hibernacula in the project area. If hibernacula sites are discovered through future research, firelines and/or restrictive dates may be imposed for that area. The largest threats to the timber rattlesnake are prescribed fires adjacent to hibernacula and indiscriminate killing of the state endangered species.

Therefore, the Houston South Project "**may impact**" the timber rattlesnake. Due to this species being listed as G4 (apparently secure) (NatureServe 2019), few sightings in the area, design criteria and the availability of existing cover habitat adjacent to the project area, there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project.

<u>Effects to Amphibians</u>
The two listed RFSS amphibians are the green salamander (*Aneides aeneus*) and four-toed salamander (*Hemidactylium scutatum*). The green salamander is in isolated populations found further south in the Tell City Unit. Due to the lack of suitable habitat (cliff communities), the species is considered not present and there would be "**no impact**" to this species or their habitat.

The four-toed salamander does occur in an isolated population in the Pleasant Run Unit over seven miles from the project site. These species prefer boggy wet sites in forested areas. These areas are not conducive to prescribed fire or timber operations and therefore would be unlikely to have negative impacts by these treatments. If the four-toed salamander was present in these areas, it is plausible that the salamander could be beneficially impacted due to the installment of vernal pools and AOPs. Therefore, the project would result in a "**beneficial impact**" to this species if present.

Due to design criteria, Forest Plan standards and that this species is listed as G5 (secure) (NatureServe 2019), there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project.

Effects to Mollusks

All of the mollusk species on the RFSS list have rivers or large streams habitat requirements that are not present in the project area. For these species, the project proposal would have "**no impact**" to these species or their habitat.

Effects to Terrestrial Invertebrates

West Virginia white (*Pieris virginiensis)* inhabits mesic forest communities associated with streams. These types of communities are present in the project area. Prescribed burning during the growing season could impact this species however; growing season burns would be less common. The West Virginia white is considered vulnerable (S3) in Indiana and G3-vulnerable nation-wide.

Since the entire project area would not be burned at once and activities would be implemented over a 12-15 year time period, untouched adjacent forest would be available for refugia. Prescribed burns could also promote more botanical diversity for this species. Therefore, the Houston South Project "**may impact**" the West Virginia white. Due to few sightings in the area, few growing season burns and the availability of existing cover habitat adjacent to the project area, there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project.

The monarch butterfly (*Danaus plexippus)* are a wide-ranging species but closely tied to milkweed plants. These plants can be found in early successional areas, roadsides and private lands throughout the project area to varying degrees. Design criteria would promote pollinator/butterfly habitat for the project through seeding and improving forest health. Creating forest canopy gaps would also increase sunlight to the forest floor and potentially produce an increase in plant diversity.

Therefore, the Houston South Project "**may impact**" and quite possibly have a "**beneficial impact**" to the monarch butterfly. Due to, few growing season burns and the availability of existing cover habitat adjacent to the project area, and since this species is listed as G4 (apparently secure) (NatureServe 2019), there should be no trend toward federal listing and no negative cumulative effects to this species from implementation of this project. All other terrestrial invertebrate species on the RFSS list have habitat requirements that are not present in the project area.

Effects to Karst Invertebrates

All of the karst invertebrate species on the RFSS list have habitat requirements that are not present in the project area. The presence of sink holes were also inspected for by ground-truthing and LIDAR. Any anomalies were evaluated by ground-truthing. No sinkholes were found during site inspections. Due to the distance of caves from the project area (over 3.5 miles), no impacts from timber operations or prescribed fire are expected. For these species, the project proposal would have "**no impact**" to these species or their habitat.

VII. Cumulative Effects

The cumulative effects geographical boundary was formulated by the potential impacts ranking to the three bat species. It was also based on the significance of the project's impact on natural resources and then given a distance proportional to this impact. Since this project is wide-ranging, would be completed in a longer time span of over 10 years and may affect bat species that can forage over longer distances, a 5-mile buffer was established for the cumulative effects geographical boundary. This is also consistent with the cumulative effects geographical boundary for the Threatened and Endangered BE (Harriss 2019).

The cumulative effects temporal boundary for this project was determined to be 20 years out. This was based on the current life of the Forest Plan and the approximate time of the project duration (12-15 years). It was logical to add an additional 5 years onto the project duration timeline to analyze effects after the

implementation would be complete. Therefore, all future activities that may occur inside the cumulative effects geographical boundary would be considered up to 20 years.

There are no municipal, county, or state projects known to be proposed within the action analysis area. However, it is assumed that standard maintenance on highways, county roads and right-of-ways would continue. Past activities that have likely affected Federally listed species within the Forest boundary include conversion of riparian areas to agricultural or residential uses, timber harvest, wildfire and grazing. Present or reasonably foreseeable future activities, which may have an impact on these species, include the construction or use of roads, continued agricultural use, timber harvest and activities associated with residential development. Private lands near the proposed action area will continue to be a mix of forest, open pasture and crop fields. See Table 4 in the BE for Threatened and Endangered Species (Harriss 2019) for a complete list of potential activities that are the most appropriate to consider for this cumulative effects analysis.

The past, present or foreseeable Forest Service activities near the project area that could directly or indirectly impact the RFSS (or potentially cause additive or synergistic adverse cumulative impacts in conjunction with the proposed action) are: the continuation of early successional management (Forest Openings Maintenance), wetland maintenance, the Buffalo Pike Project, potential trail re-routes, Pleasant Run Road Decommissioning, Lake and Pond Habitat Improvement, Jackson County AOPs, Fork Ridge Restoration and NNIS herbicide applications.

The vast majority of these activities are considered to have a long-term beneficial impact on local bat species. These activities have been analyzed under separate decisions and would not add any negative impacts to the RFSS.

The Houston South Project would not alter or create habitat suitable for most RFSS, minus the bat species and bird species considered present. The project would contribute no detrimental cumulative impacts to these species. An ongoing project (Buffalo Pike) determined to have beneficial impacts to the ruffed grouse and American woodcock. This would be a cumulative beneficial impact. Also under this ongoing project, the West Virginia white, timber rattlesnake, little brown bat and tricolored bat had “may impact” determinations. It was also determined for these five species that there would be no negative impacts and no trend toward federal listing. Therefore, there are no cumulative negative effects.

VIII. Design Criteria & Recommendations

Based upon inspection of the project area and proposed activities, I recommend implementation of the following considerations.

- *Follow Forest Plan Standards and Guidelines concerning RFSS**
- *Dates of prescribed burning and fireline placement may need re-evaluated based on future sensitive species research findings. Coordinate with the wildlife biologist on current findings **
- *Avoid early growing-season burning near known snake hibernacula when snakes are emerging**
- *Equipment should be cleaned of mud and seeds to prevent spread of NNIS before entering area**
- *Removal of hazard trees for fireline prep will be completed prior to April 15 and after September 15**
- *Promote pollinator habitat by native seeding of early successional areas and timber harvest areas when appropriate*
- *Install vernal pools on temporary skid trails or pathways, to be abandoned, where appropriate.*

** Design Criteria*

IX. Determination

Table 2 summarizes the effects of the project on RFSS listed species known to occur on the Hoosier National Forest.

Based on the above information, this evaluation determines that the proposed project would have "**no impact**" on the 6 fish species, green salamander, 2 mollusks, and 45 terrestrial invertebrates associated with barrens, and 37 cave and karst invertebrates. Since there are no effects on these species or their habitats from this project, this project would not contribute any cumulative effects to these species.

This evaluation also determines that the Houston South Project "**may impact**" the cerulean warbler, timber rattlesnake, monarch, West Virginia white and the 3 bat species.
The proposed Houston South Project would result in a "**beneficial impact**" determination to the Henslow's sparrow, woodcock, Ruffed grouse and four-toed salamander. Since there are no negative direct or indirect impacts, there are no negative cumulative effects.

Prepared by:

/S/ *Steve Harriss June 18, 2019*

Steve Harriss
Wildlife Biologist
Hoosier National Forest

SUMMARY OF POTENTIAL EFFECTS TO HOOSIER NATIONAL FOREST REGIONAL FORESTER SENSITIVE SPECIES (ANIMALS)

Table 2.

Regional Forester Sensitive Species	Habitat Type	Habitat Present?	Species Present?	Habitat Potentially Affected?	Species Potentially Affected?	Effects Determination Proposed / No Action
Mammals						
Little brown myotis *Myotis lucifugus*	K, WR	Yes	Yes	Yes	Yes	**MI / NI**
Allegheny woodrat *Neotoma magister*	C	No	No	No	No	**NI / NI**
Evening bat *Nycticeius humeralis*	WR	Yes	Yes	Yes	Yes	**MI / NI**
Tri-colored bat *Perimyotis subflavus*	K, WR	Yes	Yes	Yes	Yes	**MI / NI**
Birds						
Henslow's sparrow *Ammodramus henslowii*	O	Yes	Yes	Yes	Yes	**BI / NI**
Ruffed grouse *Bonasa umbellus*	M, D	Yes	Yes	Yes	Yes	**BI / LI**
Cerulean warbler *Dendroica cerulea*	M	Yes	Yes	Yes	Yes	**MI / NI**
Migrant loggerhead shrike *Lanius ludovicianus migrans*	O	Yes	No	Yes	No	**NI / NI**
American woodcock *Scolopax minor*	O	Yes	Yes	Yes	Yes	**BI / NI**
Barn owl *Tyto alba*	O	Yes	No	Yes	No	**NI / NI**
Fish						
Lake sturgeon *Acipenser fulvescens*	R	No	No	No	No	**NI / NI**
Northern cavefish *Amblyopsis spelaea*	K	No	No	No	No	**NI / NI**
American Eel *Anguilla rostrata*	R	No	No	No	No	**NI / NI**
Spotted Darter *Etheostoma maculatum*	R,S	Yes	No	Yes	No	**NI / NI**
Northern Madtom *Noturus stigmosus*	R,S	Yes	No	Yes	No	**NI / NI**
Channel Darter *Percina copelandi*	R,S	Yes	No	Yes	No	**NI / NI**
Amphibians						
Green salamander *Aneides aeneus*	C	No	No	No	No	**NI / NI**
Four-toed salamander *Hemidactylium scutatum*	W	Yes	Unk	Yes	Yes	**BI / NI**

Reptiles						
Timber rattlesnake *Crotalus horridus*	D	Yes	Yes*	Yes	Yes	**MI / NI**
Mollusks - Bivalves						
Ohio pigtoe *Pleurobema cordatum*	R	No	No	No	No	**NI / NI**
Salamander mussel *Simpsonaias ambigua*	R	No	No	No	No	**NI / NI**
Terrestrial Invertebrates						
Bell's roadside skipper *Amblyscirtes belli*	D, B	No	No	No	No	**NI / NI**
Comet darner *Anax longipes*	P (B)	No	No	No	No	**NI / NI**
Dusted skipper *Atrytonopsis hianna*	B	No	No	No	No	**NI / NI**
Piglet Bug *Bruchomorpha dorsata*	B	No	No	No	No	**NI / NI**
A Planthopper *Bruchomorpha pallidipes*	B	No	No	No	No	**NI / NI**
Swamp metalmark *Calephelis muticum*	B	No	No	No	No	**NI / NI**
Dejected underwing *Catocala dejecta*	B, D	No	No	No	No	**NI / NI**
A Leafhopper *Chlorotettix distinctus*	B, W	No	No	No	No	**NI / NI**
A Leafhopper *Chlorotettix nudatus*	B, W	No	No	No	No	**NI / NI**
Yellow-headed Lichen Moth *Crambidia cephalica*	B, D	No	No	No	No	**NI / NI**
Unexpected tiger moth *Cycnia inopinatus*	B	No	No	No	No	**NI / NI**
Gemmed Satyr *Cyllopsis gemma*	B	No	No	No	No	**NI / NI**
Monarch *Danaus plexippus*	WR	Yes	Yes	Yes	Yes	**MI / NI**
Three-lined angle moth *Digrammia eremiata*	B, D	No	No	No	No	**NI / NI**
Kansas preacher leafhopper *Dorydiella kansana*	B	No	No	No	No	**NI / NI**
Velvet-striped grasshopper *Eritettix simplex*	B	No	No	No	No	**NI / NI**
Mottled duskywing *Erynnis martialis*	B	No	No	No	No	**NI / NI**
A moth *Eucosma bipunctella*	B	No	No	No	No	**NI / NI**
Rustic borer moth *Eucosma rusticana*	B	No	No	No	No	**NI / NI**

Robertson's flightless planthopper *Fitchiella robertsonii*	B	No	No	No	No	**NI / NI**
Reflexed Indian grass leafhopper *Flexamia reflexus*	B	No	No	No	No	**NI / NI**
Wet Sand Savannah Moth *Gabara subnivosella*	B	No	No	No	No	**NI / NI**
Cobweb skipper *Hesperia metea*	B	No	No	No	No	**NI / NI**
Pink Prominent *Hyparpax aurora*	B, D	No	No	No	No	**NI / NI**
Prairie wainscot moth *Leucania extincta*	B	No	No	No	No	**NI / NI**
Blatchley's Walking Stick *Manomera blatchleyi*	B	No	No	No	No	**NI / NI**
Little brown cicada *Melampsalta calliope*	B	No	No	No	No	**NI / NI**
A spur-throat grasshopper *Melanoplus morsei*	B	No	No	No	No	**NI / NI**
Newman's Brocade *Meropleon ambifusca*	B	No	No	No	No	**NI / NI**
Helianthus leafhopper *Mesamia stramineus*	B	No	No	No	No	**NI / NI**
Crepitating conehead *Neoconocephalus robustus*	S (B, M)	No	No	No	No	**NI / NI**
Yellow stoneroot borer *Papaipema astuta*	M, D, B	No	No	No	No	**NI / NI**
(Beer's) blazing star stem borer *Papaipema beeriana*	B	No	No	No	No	**NI / NI**
A Leafhopper *Paraphlepsius particolor*	B	No	No	No	No	**NI / NI**
A Leafhopper *Paraphlepsius solidaginis*	B	No	No	No	No	**NI / NI**
Stinging rose (caterpillar) slug moth *Parasa indetermina*	B	No	No	No	No	**NI / NI**
A Planthopper *Phylloscelis pallescens*	B	No	No	No	No	**NI / NI**
West Virginia white *Pieris virginiensis*	M	Yes	Yes*	Yes	Yes	**MI / NI**
A Planthopper *Pissonotus brunneus*	B	No	No	No	No	**NI / NI**
Short-winged polyamia *Polyamia brevipennis*	B	No	No	No	No	**NI / NI**
Prairie bunchgrass leafhopper *Polyamia herbida*	B	No	No	No	No	**NI / NI**
Kansas Prairie Leafhopper *Prairiana kansana*	B	No	No	No	No	**NI / NI**
Southern purple mint moth *Pyrausta laticlavia*	B	No	No	No	No	**NI / NI**
A Planthopper *Rhynchomitra recurve*	B	No	No	No	No	**NI / NI**

Colorful Nymph *Scaphoideus productus*	B	No	No	No	No	**NI / NI**
Jaguar flower moth *Schinia jaguarina*	B	No	No	No	No	**NI / NI**
A Leafhopper *Texananus longipennis*	B	No	No	No	No	**NI / NI**
Karst Invertebrates						
Southeastern wandering spider *Anahita punctulata*	K	No	No	No	No	**NI / NI**
Indiana cave pseudoscorpion *Apochthonius indianensis*	K	No	No	No	No	**NI / NI**
Black medusa cave springtail *Arrhopalites ater*	K	No	No	No	No	**NI / NI**
Carolyn's cave springtail *Arrhopalites carolynae*	K	No	No	No	No	**NI / NI**
Lewis' cave springtail *Arrhopalites lewisi*	K	No	No	No	No	**NI / NI**
Krekeler's (Indiana) cave ant beetle *Batrisodes krekeleri*	K	No	No	No	No	**NI / NI**
Northern cavefish copepod *Cauloxenus stygius*	K	No	No	No	No	**NI / NI**
Bollman's cave millipede *Conotyla bollmani*	K	No	No	No	No	**NI / NI**
Barr's cave amphipod *Crangonyx barri*	K	No	No	No	No	**NI / NI**
Indiana cave amphipod *Crangonyx indianensis*	K	No	No	No	No	**NI / NI**
Packard's cave amphipod *Crangonyx packardi*	K	No	No	No	No	**NI / NI**
Jeannel's groundwater copepod *Diacyclops jeanneli jeanneli*	K	No	No	No	No	**NI / NI**
Golden cave harvestman *Erebomaster flavescens*	K	No	No	No	No	**NI / NI**
Thin Glyph *Glyphyalinia cryptomphala*	K	No	No	No	No	**NI / NI**
Southeastern Cave Pseudoscorpion *Hesperochernes mirabilis*	K	No	No	No	No	**NI / NI**
Gray-handed pseudoscorpion *Kleptochthonius griseomanus*	K	No	No	No	No	**NI / NI**
Packard's cave pseudoscorpion *Kleptochthonius packardi*	K	No	No	No	No	**NI / NI**
Campground Cave copepod *Megacyclops donnaldsoni*	K	No	No	No	No	**NI / NI**
Carter's cave spider *Nesticus carteri*	K	No	No	No	No	**NI / NI**
Fallen Springtail *Onychiurus casus*	K	No	No	No	No	**NI / NI**
Ghost (northern cave) crayfish *Orconectes inermis inermis*	K	No	No	No	No	**NI / NI**

Sinkhole crayfish *Orconectes theaphionensis*	K	No	No	No	No	**NI / NI**
Beatty's cave sheet-web spider *Oreonetides beattyi*	K	No	No	No	No	**NI / NI**
Smooth Bladetooth *Patera laevior*	K	No	No	No	No	**NI / NI**
Appalachian cave spider (cavernicolous sheet-web spider) *Porrhomma cavernicola*	K	No	No	No	No	**NI / NI**
Patton Cave ground bettle *Pseudanophthalmus sp. 33*	K	No	No	No	No	**NI / NI**
Marengo Cave ground beetle *Pseudanophthalmus stricticollis*	K	No	No	No	No	**NI / NI**
Young's Cave ground beetle *Pseudanophthalmus youngi*	K	No	No	No	No	**NI / NI**
Jeannel's cave (groundwater) ostracod *Pseudocandona jeanneli*	K	No	No	No	No	**NI / NI**
Fountain cave springtail *Pseudosinella fonsa*	K	No	No	No	No	**NI / NI**
Blue River cave millipede *Pseudotremia indianae*	K	No	No	No	No	**NI / NI**
Reynolds' cave millipede *Pseudotremia reynoldsae*	K	No	No	No	No	**NI / NI**
Salisa's cave millipede *Pseudotremia salisae*	K	No	No	No	No	**NI / NI**
Indiana groundwater copepod *Rheocyclops indiana*	K	No	No	No	No	**NI / NI**
A Springtail *Sinella agna*	K	No	No	No	No	**NI / NI**
Weingartner's cave flatworm *Sphalloplana weingartneri*	K	No	No	No	No	**NI / NI**
A Gnaphosid Spider *Talanites exlineae*	K	No	No	No	No	**NI / NI**

Rev 17 January 2018, CRC

Regional Forester Sensitive Species Effects Determinations:

NI = No impact
BI = Beneficial impact
MI = May impact individuals or habitat, but not likely to cause trend toward federal listing or reduce viability of a population or species.
LI = Likely to impact individuals or habitat with the consequence that the action may contribute towards federal listing or result in reduced viability of a population or species.
***** = No documented occurrence of the species, but presumed present due to nearby sightings and suitable habitat.
Unk = Unknown. Potential habitat occurs within the project area, some observations on the ranger district but no known occurrences nearby.

Regional Forester Sensitive Species Habitat Associations:

C = Cliffs
M = Mesic forests
D = Dry forests
B = Barrens
O = Open lands
W = Wetlands
WR= Wide-ranging species - diverse habitats
K = Caves or karst

P = Ponds, lakes, waterholes
R = Larger rivers and streams
S = Smaller streams and riparian corridors

Cliffs Cliffs are areas characterized by their vertical exposures of resistant bedrock, and may have associated overhangs. The upper portion of cliffs is often within the dry forest community while the lower part is in mesic forest.

Mesic Forests Typically dominated by large trees that create a canopy closure of greater than 80 percent. Soils drain well, and may be rocky. Their aspect and elevation largely determine which species dominate. Oaks are typical of south and west facing slopes. Beech and sugar maple are more frequent on north and east aspects and in ravine bottoms. Forest composition may vary with the type and depth of bedrock.

Dry Forests Dominated by trees which that a canopy closure of greater than 80 percent. Soils are rocky and typically excessively drained. Oaks are typical of south and west facing upper slopes and on ridgetops. Forest composition may vary with the type and depth of bedrock.

Barrens Communities having tree canopy cover of 20 to 60 percent usually of post oak (*Quercus stellata*) and a ground cover dominated by prairie grasses, especially Indian grass (*Sorghastrum nutans*), little bluestem (*Andropogon scoparius*), and big bluestem (*A. gerardii*). They have thin soils over limestone or occasionally sandstone bedrock. The barrens exist as isolated communities within the matrix of dry forests.

Open Lands Openings large enough for area dependent species occur at widely scattered locations throughout the Forest, although large open areas are much more common of non-federal lands. Large openings on the Forest may be important for maintaining populations of certain species. The dominant species at these sites consist of either native plants or non-native species, and often-varying combinations of both.

Wetlands Are flooded areas or have hydric soils, and have a cover of vegetation consisting of either woody (swamp) or herbaceous (marsh). The vegetation can be quite variable depending on frequency and duration of flooding. These areas may be either natural or artificial.

Wide-Ranging Wide-ranging species are considered those that use multiple habitats or tend to have home ranges that encompass extensive areas.

Caves/Karst Cave and karst species that are associated with true caves, rock shelters, or substantial outcrops.

Ponds This habitat designation pertains largely pertains to fish species stocked in either man-made or natural ponds, but these areas also provide habitat for some sensitive plants that inhabit wet soils along pond margins.

Rivers This designation refers to both larger streams and rivers.

Streams Habitat consists of smaller streams and adjacent riparian woodlands.

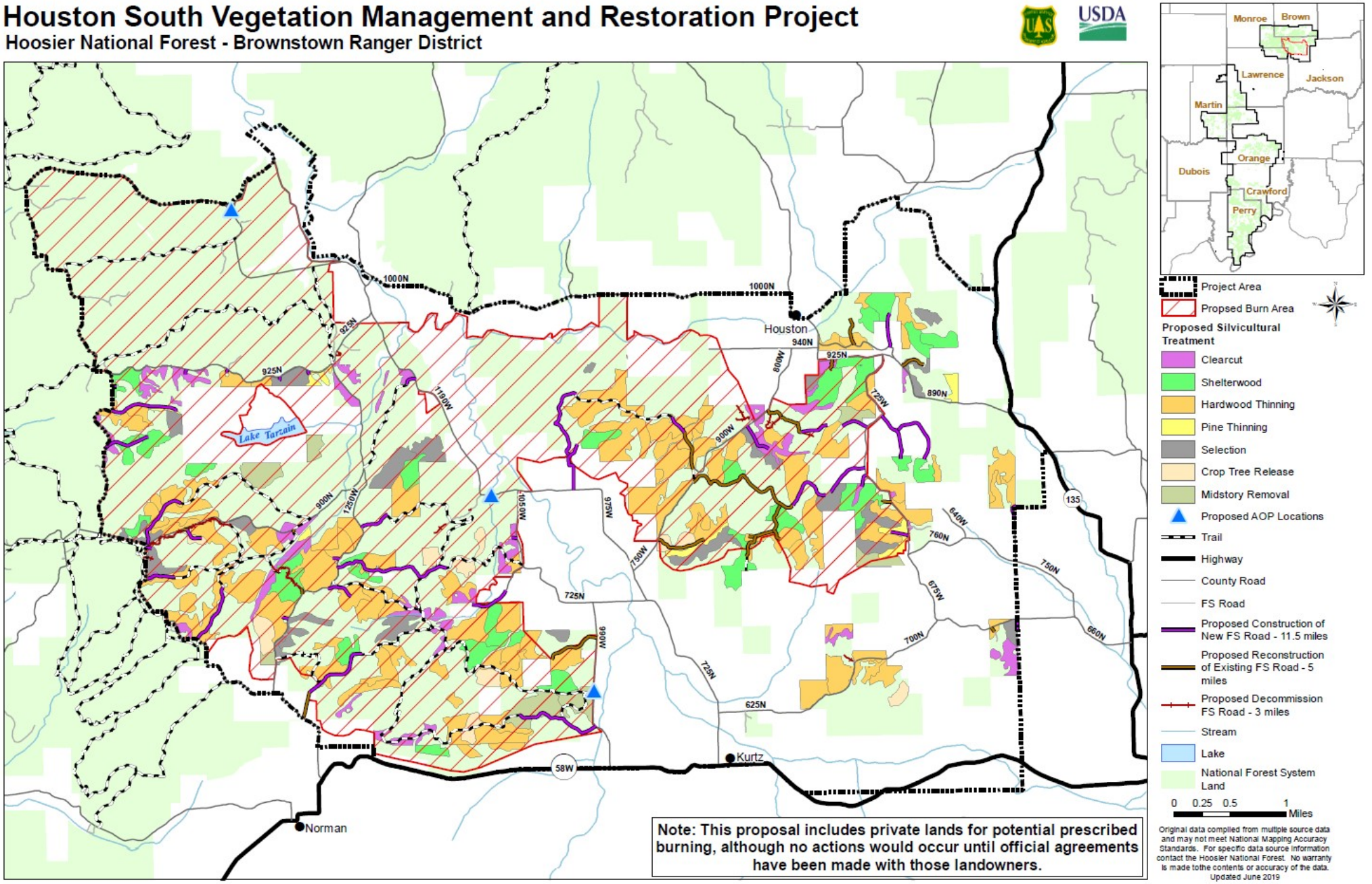

Figure 1. Map of proposed project area

IX. Literature Cited

Backs, S. 2018. Breeding Indices of Ruffed Grouse – Spring 2018. Indiana Department of Natural Resources, Division of Fish & Wildlife. Wildlife Management and Research Notes. 5p.

Beaupre, S.; Douglas, L. 2012. Responses of timber rattlesnakes to fire: Lessons from two prescribed burns. In: Dey, Daniel C.; Stambaugh, Michael C.; Clark, Stacy L.; Schweitzer, Callie J., eds. Proceedings of the 4th fire in eastern oak forests conference; 2011 May 17-19; Springfield, MO. Gen. Tech. Rep. NRS-P-102. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station: 192-204.

Brown, W.S., 1993. Biology, Status, and Management of the Timber Rattlesnake (*Crotalus horridus*): A Guide for Conservation. Society for the Study of Amphibians and Reptiles, Herpetological Circular No. 22.

Center for Reptile and Amphibian Conservation and Management. Timber Rattlesnake Fact sheet; Purdue University, Fort Wayne. (11p) http://herpcenter.ipfw.edu; https://herpcenter.ipfw.edu/outreach/Accounts/Viperidae/Crotalus/Timber%20Rattlesnake%20(Crotalus%20horridus)/TimberRattlerFactSheet.pdf

Coon, C. 2019a. Houston South Project Biological Evaluation for Regional Foresters Sensitive Species-Plants. Hoosier National Forest- Administrative Report. 30p. [On file with: Hoosier National Forest, 811 Constitution Ave., Bedford, IN 47421].

Coon, C. 2019b. Report for the Houston South Restoration and Vegetation Management EA - Effects to Plant Nonnative Invasive Species and Botanical Resources. On file with: Hoosier National Forest, 811 Constitution Ave., Bedford, IN 47421].

Dunning, Jr.; J. K. Riegel 2017. Results of the Forest Breeding Bird Monitoring Survey Hoosier National Forest, Summer 2017. [On file with: Hoosier National Forest, 811 Constitution Ave., Bedford, IN 47421]. 8p.

Gibson, S. E. 2003. Movements and habitat preference of the Timber Rattlesnake (Crotalus horridus) in southern Indiana. MS Thesis, Purdue University, Fort Wayne, IN.

Harper, C.A., Ford, W.M., Lashley, M.A. et al. fire ecol (2016) 12:127. https://doi.org/10.4996/fireecology.1202127

Harriss, S. 2019. Houston South Project Biological Evaluation for Threatened and Endangered Species. Hoosier National Forest. Administrative Report. [On file with: Hoosier National Forest, 811 Constitution Ave., Bedford, IN 47421].

Harriss, S. 2016. Results of the 2016 woodcock singing ground survey, Hoosier National Forest. Administrative report. [On file with: Hoosier National Forest, 811 Constitution Ave., Bedford, IN 47421]. 6 p.

Harriss, S. 2014. Results of the 2014 woodcock singing ground survey, Hoosier National Forest. Administrative report. [On file with: Hoosier National Forest, 811 Constitution Ave., Bedford, IN 47421]. 6 p.

Indiana Department of Natural Resources (IDNR) 2018, Division of Fish & Wildlife Endangered and Special Concern Species List. https://www.in.gov/dnr/naturepreserve/files/fw-Endangered_Species_List.pdf

Indiana Department of Natural Resources (IDNR). 2015. Indiana Natural Heritage Data Center, Division of Nature Preserves, Indiana Department of Natural Resources. www.state.in.us/dnr/naturepr/index

Indiana Department of Natural Resources (IDNR). 2012. Indiana Natural Heritage Data Center, Division of Nature Preserves, Indiana Department of Natural Resources. www.state.in.us/dnr/naturepr/index

Indiana Department of Natural Resources (IDNR) 2011 Wildlife Diversity Report — Timber Rattlesnake. https://www.in.gov/dnr/fishwild/files/fw-11WildlifeDiversityReportResearchRattlesnake.pdf

Indiana Department of Natural Resources (IDNR) 2010 Wildlife Diversity Report—Timber Rattlesnakes. https://www.in.gov/dnr/fishwild/files/fw-10WildlifeDiversityReportResearchRattlesnake.pdf

Indiana Department of Natural Resources (IDNR) 2009 Wildlife Diversity Report—Timber Rattlesnakes. https://www.in.gov/dnr/fishwild/files/fw-09WildlifeDiversityReportResearchRattlesnake.pdf

MacGowan, B.; Currylow, A.; MacNeil, J. 2016. Short-term Responses of Timber Rattlesnakes (Crotalus horridus) to even-aged timber harvests in Indiana. Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907, USA.

McClanahan, R. 2014. Unpublished Survey Report – personal communication. Permission given on 06/11/2014.

McClanahan, R. 2010. Indiana bat mist net surveys and radio telemetry summer roost tree monitoring for the Hoosier National Forest. 40p. [On file with: Supervisor's Office, Hoosier National Forest, Bedford, Indiana.]

NatureServe. 2019. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: June 16, 2019).

Perry, R.; Thill, R. 2007. Tree Roost Selectionby Male and Female Eastern Pipistrelles in a Forested Landscape. 8. [On file with: Hoosier National Forest, 811 Constitution Ave., Bedford, IN 47421].

Reinert, H.; Munroe, W.; Brennan, C.; Rach, M.; Pelesky, S.; Bushar, L. 2011. "Response of Timber Rattlesnakes to Commercial Logging Operations," Journal of Wildlife Management, 75(1), 19-29. https://doi.org/10.1002/jwmg.35

U.S. Department of Agriculture, Forest Service (USDA FS). 2006. Land and Resource Management Plan, Hoosier National Forest.

U.S. Department of Agriculture, Forest Service (USDA FS). 2005. Programmatic Biological Assessment of the Hoosier National Forest Land and Resource Management Plan. Administrative Report. [On file with: Supervisor's Office, Hoosier National Forest, Bedford, Indiana.]

U.S. Department of Agriculture, Forest Service (USDA FS). 1991. Forest Service Manual 2600. Wildlife, Fish, and Sensitive Plant Habitat Management. WO Amendment 2600-91-5. 12 p.

U.S. Department of the Interior. Fish and Wildlife Service (USDI FWS). 2019. Informational Website for White-nose Syndrome. https://www.whitenosesyndrome.org/.

U.S. Department of the Interior. Fish and Wildlife Service (USDI FWS). 2006. Biological opinion of the Proposed Land Resource Management Plan, Hoosier National Forest, Indiana. USDI Fish and Wildlife Service, Bloomington Field Office. [On file with: Supervisor's Office, Hoosier National Forest, Bedford, Indiana.]

Van Kley, J.E.; Parker, G.R.; Franzmeir, D.P.; Randolph, J.C. 1995. Field Guide: ecological classification of the Hoosier National Forest and surrounding areas of Indiana. Bedford, Indiana. U.S. Department of Agriculture, Forest Service, Hoosier National Forest. 75 p. [On file with: Supervisor's Office, Hoosier National Forest, Bedford, Indiana.]

Veilleux, J. P., J. O. Whitaker, Jr., and S. L. Veilleux. 2003. Tree-roosting ecology of reproductive female eastern pipistrelles, *Pipistrellus subflavus*, in Indiana. Journal of Mammalogy 84:1068-1075.

Walker, Z. J. 2000. The spatial ecology of the Timber Rattlesnake (*Crotalus horridus*) in south central Indiana. MS Thesis, Purdue University, Fort Wayne, IN.

Whitaker, J. O., Jr; Gummer, S. L. 2003. Current status of the evening bat, *Nycticeius humeralis*, in Indiana. Proceedings of the Indiana Academy of Science 112:55-60.

York-Harris, M. 2016. Unpublished Survey Report – personal communication. Permission given on 07/17/2016.

Zhalnin, Andriy Vladimirovich. 2004. Delineation and spatial analysis of ecological classification units for the Hoosier National Forest. Ph.D. dissertation. Lafayette, IN: Purdue University, 267 pp. [On file with Forest Supervisor, Hoosier National Forest, 811 Constitution Ave., Bedford, Indiana 4742.